Design Of Temperature Control Unit

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Abstract-

Temperature control unit (TCU S) is the group of different devices which are fixed in a close loop. The aim of this design of TCU is to maintain constant temperature in its machinery at optimum cost. In this system tempered water is used at controlled temperature, is circulating through the machinery using pump. This water is heated using steam or electrical heater and cooled through chilled water by the heat exchanger as per requirement by using single point pneumatic temperature control. In this paper we will design the temperature control unit considering the steam as heating age.

Introduction-

This unit is designed for rubber industry and plastic industry, applying all kind of industrial mixture extruders, calendar vulcaniser and so on, as well as chemical industry and other industry to incident temperature control.

Is has the function of intelligent control when changing control methods and software program in PLC.

The mechanical has two independent units of mechanical system and electrical control system, they can be integrated as a whole also installed separately to central control.

TCU'S provides control of process temperature by circulating water through theprocess application. These units use a pump to circulate the fluid through the process.

A heating and cooling valves work together to control the temperatures of fluid.

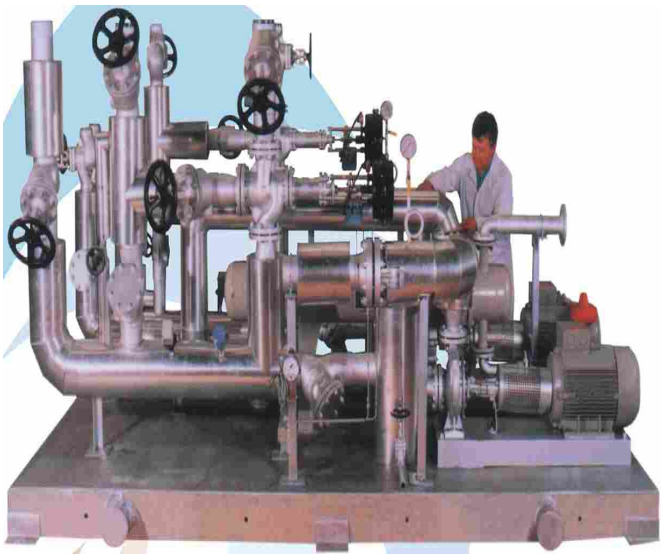


Fig1

TCU'S are portable and plant water supply source of different control instruments

They all-

1-Shell and tube type heat exchanger

2-Control valves

3-Pumps

4-PLC & Control

Shell and tube type heat exchanger are used for maintaining heating and cooling. Due to the more performance of counter flow, counter flow shell and tube type heat exchanger are preferred.

Shell-and-tube heat exchangers contain a Large number of tubes (sometimes several Hundred) packed in a shell with their axes Parallel to that of the shell

Heat transfer
Q=ΔT/R
ΔT called the temperature difference between the fluids

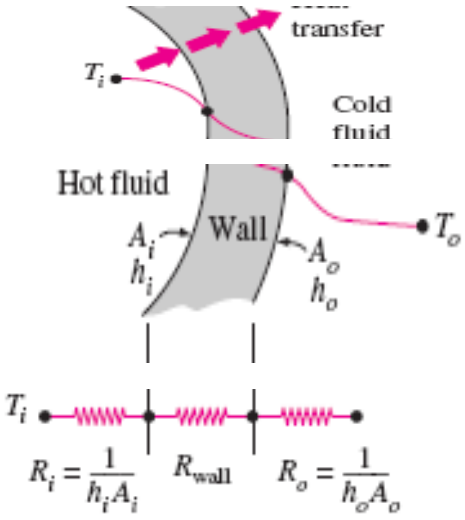


Fig2

Internal area & outer area of tubes
Ai = πDi
Ao = πDo
Total resistance
$R_{total} = R_i + R_o + R_{wall}$
$=1/h_iA_i+1/h_oA_o+\ln(D_o/D_i)/2\pi Lk$

The performance of heat exchangers Usually deteriorates with time as a result Of accumulation of deposits on heat Transfer surfaces. The layer of deposits Represents additional resistance to heat Transfer and causes the rate of heat Transfer in a heat exchanger to decrease. Precipitation fouling of ash particles on Super heater tubes from Steam; it's **of** the thermal resistance introduced by fouling. The deposition of scale on heat transfer surface reduces the
Heat transfer rate and increase the pressure drop and pumping power

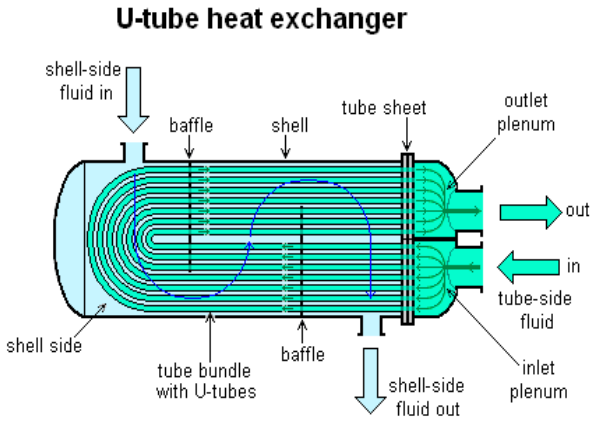


Fig3

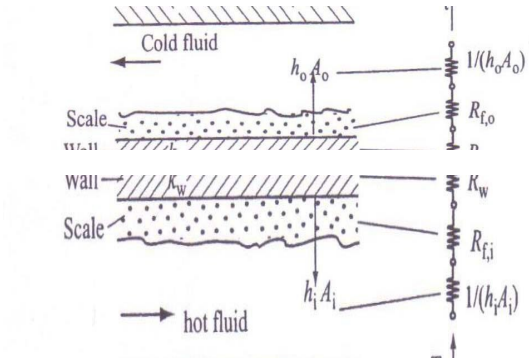


Fig4

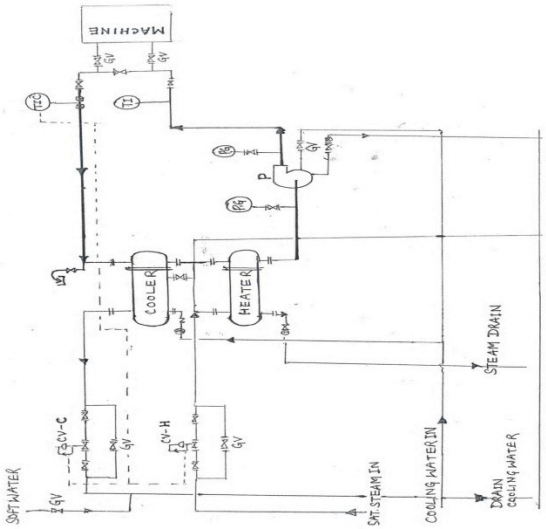
Through changes in temperature evaporation, degasification, the concentration of salts may exceed the saturation leading to a precipitation of solids (usually crystals).
As an example, the equilibrium between the readily soluble calcium bicarbonate always prevailing in natural water - and the poorly soluble calcium bicarbonate the following chemical equation may be written:

$$Ca(HCO_3)_2(aqueous) \longrightarrow CaCO_3\downarrow + CO_2\uparrow + H_2O$$

The calcium carbonate that forms through this reaction precipitates. Due to the temperature dependence of the reaction, and increasing volatility of CO_2 with increasing temperature, the scaling is higher at the

hotter outlet of the heat exchanger than at the cooler inlet.

Piping and instrumentation diagram-



An important means for engineering communication in the process industry is the so called Process & Instrumentation (P&I) diagram. Figure shows the P&I diagram of a typical industrial heat exchanger. Heat exchanger is a process unit in which steam is used to heat up a liquid material. The material (called feedstock) is pumped at a specific flow rate into the pipes passing through the heat exchanger chamber where heat is transferred from steam to the material in the pipe. It is usually desired to regulate the temperature of the outlet flow irrespective of the change in the demand (flow rate) of the feedstock or change in the inlet temperature of the feedstock. The regulation of the outlet temperature is achieved by automatic control of the steam flow rate to the heat exchanger. The P&I diagram utilizes certain standard symbols to represent the process units, the instrumentation, and the process flow.

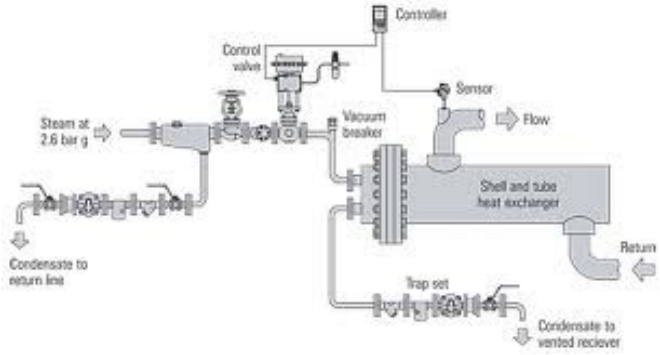


Fig5

Steam to Water heat exchange condensate form

The operation of the shell and tube heat Exchanger is as follows. Steam enters the Heat exchanger shell through the top Vapor opening and surrounds the outside Of the tubes. As energy is transferred Through the tubes it heats the water inside The tubes. The heat transfer condenses Steam inside the shell forming condensate That drops to the bottom of the heat Exchanger shell. The condensate flows Through the bottom condensate outlet and into a steam trap

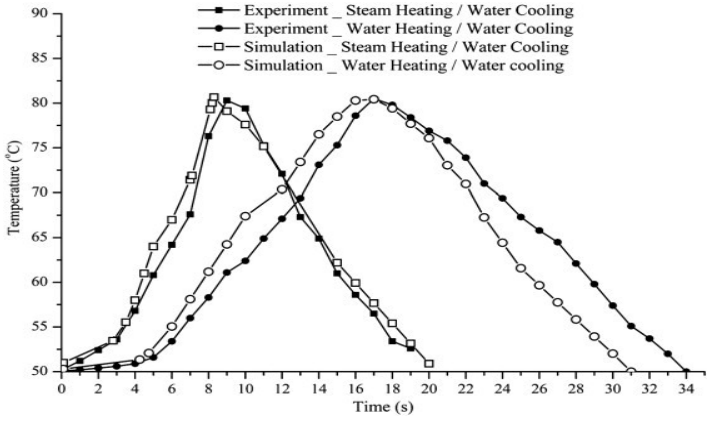


Fig6

Graph shows the steam heating and water cooling.

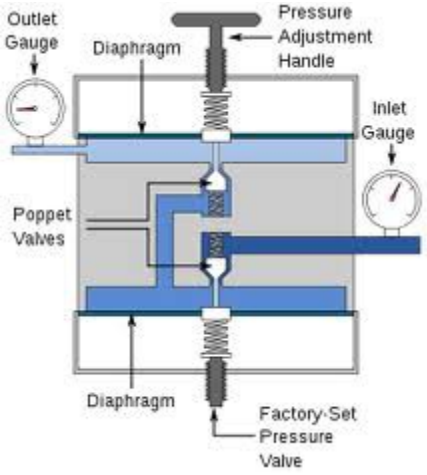


Fig7

Normally stainless steel is used to control the flow by a movement of diaphragm. Upstream and downstream pressure or an external source like pneumatic or hydraulic can be used to change the position of diaphragm. It have following features due to which is suitable for that purpose

Flexibility & adaptability-suitable for pneumatic and hydraulic operation. Minimum no of parts, compact, low maintenance etc.Diaphragm valves (or membrane valves) consists of a valve body with two or more ports, a diaphragm, and a "weir or saddle" or seat upon which the diaphragm closes the valve. The valve is constructed from either plastic or metal. There are two main categories of diaphragm valves: one type seals over a "weir" (saddle) and the other (sometimes called a "full bore or straight-way" valve) seals over a seat. The weir or saddle type is the most common in process applications and the seat-type is more commonly used in slurry applications to reduce blocking issues but exists also as a process valve. While diaphragm valves usually come in two-port forms (2/2-way diaphragm valve), they can also come with three ports (3/2-way diaphragm valves also called T-valves) and more (so called block-valves)

Conclusion-

It is right that for the process industries machines work regularly due to which temperature of parts and component have to control with temperature control unit .With the help of this paper design of TCU will provide optimum range of satisfactory. The maintenance cost of the system will not high easy to handle. By pass of steam and standby are provide flexibility of system. No leakage is found. Easily to repair the parts and fix.Diaphragm valve give self opening and closing for steam which is regulated by the pneumatic or hydraulic source of energy.plc programming is provided to drive the system automatically. So we can say that automatic temperature control unit.

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